

AIF MINISTRY

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FIRST ISSUE.

No. G 392

September 1936.

SPECIFICATION

for

BOMBING TEACHER

MARK III.

This Specification consists of: Three Sections, viz.,
Sections I, II & IV of the following:

- Section I - List of Drawings
- II - Particular Requirements
- III - Dial or other markings
- IV - General Clauses.

Inst./293/46.

Page No. 1.

No. of Pages 1.

Amendment List No. 1 December 1937

to

Air Ministry Specification No. G.392 First Issue

for

Bombing Teacher Mark III.

SECTION I - SCHEDULE OF DRAWINGS.

Drg. No. H.17732

New Drawing added at Issue I.

Amendment List	1	2	3	4	5	6
Date	Dec 1937					

Note: On issue, amendment lists should be attached to the front page of the specification, and the date of issue entered in the above table.

Inst/293/29

First Issue
G.392
September, 1936

AIR MINISTRY

SPECIFICATION
for
BOMBING TEACHER MK.III.

SECTION I - SCHEDULE OF DRAWINGS

Drawing No.	Title
H.15331 Sheet 1	General Arrangement. Plan
H.15331 " 2	" " Elevation
H.15331 " 3	" " Side elevation
H.15331	Schedule
H.16303	G.A. V.S.D. Mark II.
H.15505	Details
H.15506	"
H.15507	"
H.15508	"
H.15509	"
H.15510	"
H.15511	"
H.15512	"
H.15513	"
H.15514	"
H.15515	"
H.15516	"
H.15517	"
H.15518	"
H.15519	"
H.15520	"
H.15521	"
H.15522	"
H.15523	"
H.15524	"
H.15525	"
H.15526	"
H.15527	"
H.15684	"
H.15691	General arrangement. Timing Gear.
H.15877	Details
H.15914	"
H.15915	"
H.16070	"
H.16113	"
H.16140	"
H.16375	G.A. of Gear Box (3 speed)
H.16413	Details.

Drawing No.	Title
H.15685	Schedule. Compass gear.
H.15685	Details
H.15686	"
H.16065	Schedule. Wind chart.
H.16065	Details
H.16070	"
H.16073-1	Schedule. Shafting etc.
H.16073	Details
H.16122	"
H.16091	Schedule. Rudder and resistance unit.
H.15526-2	Details
H.15687	"
H.16074	"
H.16075	"
H.16091 Sheet 1	General arrangement. Rudder bar.
H.16091 " 2	" " Resistance unit.
H.16103	Schedule. Dust cover.
H.16103	Details
H.16109	"
H.16112	"
H.16115	"
H.17732	

SECTION II - PARTICULAR REQUIREMENTS.

Note: The contract will state the Stores Reference Number, see Clause 9 (b).

1. APPLICATION. The Bombing Teacher Mark III is designed to give ground instruction and practice in dead reckoning navigation, bombing and similar subjects, and provides a representation of the apparent motion of the ground as seen from an aircraft.
2. GENERAL DESCRIPTION. The apparatus transmits traversing and rotating motions to a special lantern plate. A portion of this lantern plate is projected optically on to a horizontal screen as it passes over a short focus projecting lens. The traversing motions are produced by two lead screws at right angles to each other which are driven by variable speed gear boxes. The lantern plate, lead screws and variable speed gear boxes are mounted on a large diameter wheel. A drum, mounted above the hub of the large wheel can be offset and rotated by remote controls. Two spring loaded arms at right angles to each other bear against this drum and their ends form racks to control the output speeds of the variable speed gear boxes to the lead screws. The motive power is provided by two fractional horse-power electric motors. One motor, which drives the lead screws for the traversing motions, is pre-set governed to run at a constant speed. This Motor drives a stationary three speed gear box and then drives through worm gearing, sprockets and roller chains to the two variable speed gear boxes mounted on the large wheel. This constant speed motor also drives a magnetic timing mechanism. The other motor drives the large diameter wheel for the rotating

motion of the lantern plate and has both its speed and direction of rotation controlled by an arrangement of variable resistances which is operated from a rudder bar.

A pivoted block, arranged to carry large and small permanent magnets for neutralising the earth's field in the region of a magnetic compass, is rotated by means of worm gearing and shafting as part of the apparatus. A special condenser system and a short focus lens are used for projecting a small portion of the moving lantern plate. A five hundred candle-power "Point-o-lite" lamp provides the illumination.

3. GENERAL CONSTRUCTION.

- (a) The apparatus shall be constructed in accordance with the drawings specified in Section I of this specification.
- (b) The B.S.I. standard limits for fine instrument work shall apply.
- (c) Except where otherwise stated in the drawings, screw threads shall be of Whitworth form and B.S.I. standard fits.
- (d) The apparatus shall be so robust as to withstand all ordinary conditions of handling without derangement.
- (e) The apparatus shall be as rust-proof as possible.
- (f) (i) The materials used shall be of the best quality throughout and free from defects. No attempt shall be made to correct defects by patching, welding or soldering.

(ii) Where materials are specified by numbers in the drawings, the reference is to the latest issue of British Standards or Air Ministry D.T.D. specifications.
- (g) The work shall be carried out in the best and most suitable manner and to the satisfaction of the Inspector.
- (h) Detail assemblies on the large diameter wheel shall be located thereon by dowel pins.

4. DETAILED CONSTRUCTION.

- (a) Variable Speed Drive Mk. II. The variable speed gear boxes form the subject of a separate specification. They will be supplied to the contractor by the Director of Contracts, Air Ministry.
- (b) Timing Gear. The timing gear forms the subject of a separate specification.

The gear will be supplied to the Contractor by the Director of Contracts, Air Ministry. The driving worm and wormwheel shall be packed with anti-freezing grease to Stores Reference No. Sec. 34A/49 at assembly.

(c) Optical System. Particulars for the purchase of the special aplanatic condenser and 1.4 inch focus F.2 aperture projection lens may be obtained from the Director of Contracts, Air Ministry.

(d) Motors.

(i) Traversing. This motor shall be wound for 100 volts D.C. rated at 1/30th horse power, and shall be pre set governed to run at 3000 r.p.m. The motor, governor and resistances shall be self contained and mounted as one unit on a baseplate. The motor shall run as a shunt motor but the armature and field connections are required to be brought out to separate terminals. A motor catalogued by Messrs. The Croydon Engineering Co. Ltd. of Croydon as a preset, governed, type MB or similar motor, will meet the requirements of this specification. It is important that the height of each motor supplied shall be 3.65" to the centre line of the armature shaft.

(ii) Rotation. This motor shall be wound for 100 volts D.C. rated at 1/30th horse power, and shall be worm geared down to a shaft speed of 15-20 r.p.m. The worm gear box shall form a unit with the motor. The motor shall run as a shunt motor but the armature and field connections are required to be brought out to separate terminals. A motor catalogued by Messrs. The Croydon Engineering Co. Ltd. of Croydon as type MB geared to 15 r.p.m. or similar motor will meet the requirements of this specification.

(e) Sliding Resistances. The sliding resistances shall have vitreous enamelled tubes 12 inches long wound for 500 ohms at one amp. The sliders shall be fitted with copper carbon brushes in place of the laminated copper brushes usually provided. The resistances shall be assembled as shown on the relevant drawing.

(f) Lamp Mechanism. The source of light shall be a "Pointolite" Lamp of 500 candle power, 100 volts D.C., 4 inches diameter, fitted with a screwed cap. Two such lamps shall be provided with each equipment. The "Pointolite" resistance, switch and lampholder shall be of the latest pattern and shall be designed to operate from 100 volts D.C. The "Pointolite" lamp and switchgear are proprietary articles, and may be obtained from Messrs. The Edison Swan Electric Company.

(g) Metal Rectifier. A metal rectifier shall be supplied with each equipment to convert the A.C. mains supply to 100/120 volt D.C. The rectifier is a proprietary article manufactured by Messrs. The Westinghouse Brake and Signal Co. Ltd., of Kings Cross, London, and is their No. RTF 4-24-12. full wave bridge connected, double wound core type. The single phase A.C. supply and periodicity will be stated in the order and the D.C. output (mean) shall be 100/120 volts D.C., 7 amps.

(h) Glass shall be polished plate, transparent and free from veins or air bubbles.

(i) Bevel Gears. The tooth form of all bevel gears shall be of the involute type. These gears shall not be finished by means of a milling cutter but shall be generated to the correct form. The teeth, when correctly in mesh, shall engage on the full length of the face with the minimum of backlash.

- (j) Lead Screws. The lead screws shall be ground straight and the traversing nuts shall rotate freely on the threads without backlash. The spring pins shall be accurately located with the traversing nuts so as to prevent backlash between the nuts and their housings.
- (k) Worm gearing. All worm and wormwheels shall be accurately centred and the wormwheels shall be gashed and hobbled from their worms. They shall operate without appreciable backlash.
- (l) Machining and fitting. The machining operations shall be of high quality and moderately high dimensional accuracy. In order to secure the interchange of like parts the machining shall be performed by the aid of jigs. The fitting shall be of a degree suitable for this class of work. All rotating parts shall work smoothly without jerkiness and be of a good fit so as to eliminate backlash as far as possible. Adjusting and clamping screws shall be a good fit but shall be free enough for hand manipulation.
- (m) Pilots seat. The pilots seat shall be supplied in parts ready for assembly and the necessary nuts and bolts shall be included.
- (n) Wind Chart. One wind chart as called for on the relevant drawing shall be supplied with each equipment. The markings may be photo etched.
- (o) Rudder Bar. One rudder bar as called for on the relevant drawings shall be supplied with each equipment.
- (p) Platform. The platform as called for on the relevant drawing shall be supplied in parts ready for assembly and the necessary screws and bolts shall be included.
- (q) Cover. The cover shall be as called for on the relevant drawings. The slides shall be easily operated and the whole shall be dust-proof.

6. ADJUSTMENT.

- (a) Micrometer settings. All micrometer hand settings shall be pinned at assembly so as to read correctly against their appropriate scales.
- (b) The variable speed gear boxes shall be adjusted so that the traverse of the driving ball is along a diameter of the disc. The disc thrust housing is bored slightly eccentric and may be rotated to effect this adjustment.
- (c) Traverse the driving ball until it is exactly coincident with the disc centre. This must be done by measurement from each side of the disc. With the driving ball in this position scribe a fine line on the traverse drive shaft and its housing.
- (d) Set enemy speed micrometer to read zero. The drum situated about the optical system should then be concentric in the wormwheel ball bearing. Set the whole sliding gear concentric about the large wheel axis. Scribe a fine line on the sliding frame and guide rail in this position.

(e) From this central position the whole sliding frame shall be capable of 1.05 inches displacement along the axis of the girder frame in the direction of the air speed screw.

(f) Set the drum concentric with the wheel axis as at para. (d) and adjust the spring loaded arms so that the traverse pinions of the variable speed gears will mesh in the centre of the wind racks. The wind micrometers must be set to read zero in each case. Line up scribed lines, para.(c) on variable speed gears and mesh pinions with the wind racks.

7. ENGRAVING.

(a) All lettering and engraving shall be boldly cut, clean and of sufficient depth to retain permanently the colour filling body which shall be of a hard and durable quality.

(b) The engraving of all scales shall be accurate to ± 0.002 inches.

8. FINISH.

(a) The finish shall be to the satisfaction of the Inspector.

(b) All aluminium alloy parts are to be anodically treated.

(c) Wherever possible all metal parts on other than working surfaces shall be fine abrasive blasted, treated with enamel, stoved and finished semi-dull black in accordance with D.T.D. specification 56A. This shall apply except when parts are called for in the drawings to be nickel plated.

(d) All scales are to be filled with hardening colour body as specified in the drawings.

9. IDENTIFICATION MARKS.

(a) The Government mark, consisting of a Tudor Crown surmounting the letters A.M. as set out on the back cover of this specification shall be depth engraved on the upper surface of the large diameter wheel.

(b) Adjacent to the Government mark the following marking shall be engraved:-

Stores Reference Number
Bombing Teacher, Mk.III.
Maker's Name.
Serial No.

(c) The serial number will be one of a series which will be allocated by the Director of Contracts, Air Ministry.

10. PACKING AND LABELLING.

(a) All the components of this apparatus shall be packed in

suitable stout wooden cases and the contents of each case shall be stencilled in $\frac{3}{4}$ " inch letters on one side.

(b) When packed each component shall be capable of withstanding all transit risks, including shipping risks, without derangement.

SECTION IV - GENERAL CLAUSES.

1. ALTERATIONS AND MODIFICATIONS.

- (a) Each article shall comply with this specification.
- (b) Where latitude is permitted in this specification in respect of manner, means or materials, full particulars as to the proposed manner, means and materials shall be submitted for approval with the tender.
- (c) The Ministry will at any time welcome suggestions as to the alterations or modifications which in the Contractors opinion would improve the design of the article or increase the rate of production, and such suggestions will be considered by the Director of Technical Development. Such suggestions should be addressed to the Director of Contracts.

2. DRAWINGS.

- (a) The dimensions and general arrangement of the article shall be preferably as shown on the relevant drawing.
- (b) Other designs may be accepted provided they comply in other respects with this specification. Full particulars of such alternative designs shall be submitted with the tender.
- (c) No addition to, or correction of the drawings shall be made without prior approval in writing by the Director of Technical Development. Such approval should be requested from the Director of Contracts.

3. SAMPLE.

- (a) A complete article shall be submitted to the Director of Aeronautical Inspection for approval, and approved, before any deliveries are made.
 - (b) No departure from the submitted sample shall be incorporated without prior approval in writing by the Director of Technical Development. Such approval should be requested from the Director of Contracts.
 - (c) In the case of a contractor who has previously submitted a sample to the current specification and proposes to supply further articles conforming to the same sample, a second sample may not be required.
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A.M.

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